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Edited by JOHN BARTLETT.

PHOTOGRAPHIC CRITICS.

THE position of judge on a modern committee at a photographic exhibition where awards are to be made according to the good and bad qualities of the work shown, is to our thinking one far from being a sinecure. There is, indeed, a class of mankind who prefer to sit in judgment upon the work of others rather than attempt anything with their own hands, but this inertia (not to call it by a harsher name), is generally punished by the more than liberal amount of odium which their expressed opinions draw down upon them.

Unpleasant as the position of judge or critic may be, it is one that must be filled however, and the question, whom shall be chosen, often involves the nicest of considerations and the most conflicting interests.

A popular conception or misconception, rather, of the word "critic," is a carping, fault-finding individual, who speaks badly of everything merely for the pleasure of doing so. Ground enough for the formation of such a popular opinion has certainly been given. Men to whom the compliment is paid of being asked to pronounce upon the merits and demerits of the work of their colleagues, are only too apt to presume upon the honor and to become hypercritical, and having had their heads perhaps a little turned by their new position, think that by indiscriminately condemning everything, people at large will be impressed with a sense of their knowledge and experience.

The special qualities to be looked for in those who are to serve as judges upon exhibition committees, etc., are, to our thinking, first, a knowledge of practical photography, and second, the power of keeping the discriminating faculties clear, cool, and unprejudiced. In other words, such persons should remember that they are filling the honorable office of critics, which is only another word for judges, and that they are quite as free to praise what is excellent as to condemn what is faulty.

As we have just said, a knowledge of practical photography is highly desirable in those who are to judge of the work of others, but the very reverse of this will often be a valuable quality in some of those whose decision is to be final. Why, and how? it will be asked. Submit work to the criticism of those who are notoriously ignorant of the details or even the general practice of the art? And the answer is that the opinion of those who, not being trained photographers, will judge of the picture on its own merits as a picture, and not have their attention distracted by technical details, will sometimes prove very valuable and useful. If we were writing this in respect to the criticism of paintings in oil or water color, we should modify our word-

ing very materially, but for such an art as photography—one of whose chiefest charms is intense realism, a realism which, nevertheless, must be handled with an artist's skill if it is to produce a proper effect—we are sure that the voice of those ignorant of matters photographic will sometimes be a useful one on a committee of practical photographers.

The experience of years teaches us that in only too many cases, prizes are awarded to work quite unworthy of the honor. How is this? Simply, the prize has to be given whether the work be good or not. To put it in other words, there is no absolute standard of merit kept in view, but only a relative one. This is a great misfortune, and a great drawback to the advance of our art, both in the technical and the artistic directions. It is surely a matter of no such great difficulty now-a-days to form an intelligent opinion as to what constitutes excellence in a photograph, and thus to arrive at an absolute standard. The difficulty, we take it, will be found rather in the classification of different kinds of work made at different times and under different conditions, and in the liability to confuse class with class.

The mechanical part of photography being daily more attentively studied and better understood, we believe it plain to everybody that prizes will in future not be so frequently awarded for mere excellence in *technique*, save in cases where there have been peculiar or great difficulties to overcome. For the intelligent understanding of these difficulties and the due appreciation of the degree in which they have been gotten over, the judgment of the practically trained photographer is the only one worth having. But if we turn to other classes of photographic work, such as the charming bits of landscape, bits of interior life, *genre* studies, groups, portions of the beautiful details of plants, of clouds, of nature in all sorts of varied forms which our cultivated amateurs are now so busy in producing, we see immediately that intelligent criticism of such efforts will require a great deal more than the mere cool correctness of the trained photographic operator. Such work often rises to the dignity of art, and can be criticised fairly by those alone who have made the study of art a principal part of their education. It is with regard to such work as this that we often feel the truth of the saying that the failures of some are better than the successes of others.

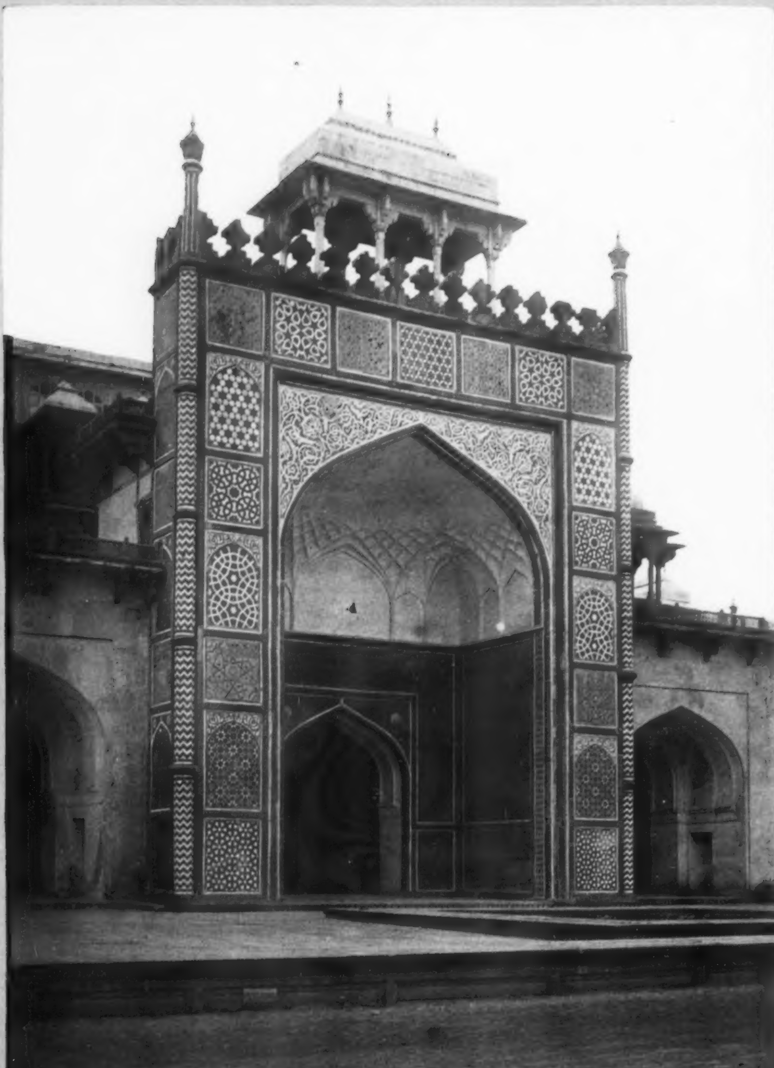
ELLERSLIE WALLACE.

PHOTOGRAPHING PROJECTILES.

DURING the past few years a number of experiments have been made in Germany for the purpose of determining the action of projectiles in causing disturbances of the atmosphere, and as the results obtained by means of photography confirmed in a most remarkable manner the theoretical deductions, it is thought that a discussion of the methods employed will be of interest to photographers generally.

When a projectile, such as a rifle ball, flies through the air, its action upon the atmosphere is not unlike that of a vessel moving through the water, with this important difference, that a vessel is only partly submerged, while the bullet is entirely surrounded by the air.

The air directly in front of the projectile becomes condensed as it is driven forward, and the condensation increases with the velocity. This condensation will naturally produce a corresponding rarefaction in the wake of the shot, which will then



TEMPLES AND TOMBS OF INDIA.

EAST GATEWAY LEADING TO TOMB OF AKBAR.

MORGAN'S BRILLIANT ALBUMEN PAPER.

NEGATIVE BY CHARLES R. PANCOAST,
WATERBURY, CONN.

cause a whirling disturbance to follow as the air closes in again upon the rarefied space.

Now while this condensation takes place even at low velocities, yet it is not perceptible until the velocity of the projectile becomes greater than the velocity of sound; that is, about 1090 feet per second, when with the proper apparatus the wave of condensed air can readily be perceived. As the velocity of the shot increases the air in front becomes more and more dense, until its velocity becomes equal to that of the shot itself, after which all cause for further change is removed, and the condensation in front of the shot remains the same in shape and size.

The shape of the wave of condensed air is that of a curve running backwards from the vertex of the projectile with a continually decreasing curvature gradually merging into straight lines and resembling one branch of an hyperbola, although the exact curve has not yet been accurately determined. Lines of condensation can also be marked emanating from the rear of the shot, making an angle with the axis which varies with the velocity. It is within the limits of these last-mentioned lines that the partial rarefaction takes place, and when the velocity is very high the air rushes into the rarefied space in whirls which are plainly determined.

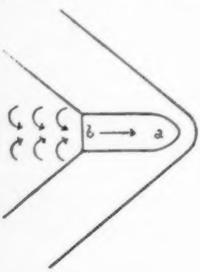


FIG. 1.

In Fig. 1 is shown a shot, *a–b*, and the wave of condensation preceding it, while within the limits of the rear lines of condensation are seen the whirls rushing into the vacuum.

Following out this theoretical view of the case a diagram such as is shown in Fig. 2 may be plotted, showing the curves of equal density for any assumed velocity, and the action of the projectile in forming such waves is quite evident.

In order to confirm the theory of these waves of condensation and rarefaction, experiments have been made by Professor E. Mach and P. Salcher, of the Imperial Austrian Naval Academy, and a translation of their papers appears in the current volume of the proceedings of the U. S. Naval Institute at Annapolis.

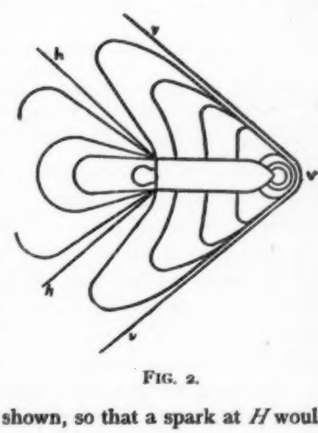


FIG. 2.

As the object of the experiments was to obtain a photograph, not only of the projectile itself but also of the atmospheric disturbances surrounding it, the difficulty of the task will at once be apparent to those familiar with photographic methods. No shutter could be found quick enough to secure images of waves whose velocity exceeded that of sound, and hence the flash of the electric spark from a Leyden jar was used to make both the illumination and the exposure. A sketch of the apparatus used is shown in Fig. 3.

The camera was placed at *C*, with its lens in focus of a larger objective at *F*. The Leyden jar was placed at *B*, with its connections made as shown, so that a spark at *H* would

be in the conjugate focus of the objective *F*. The projectile *K*, discharged from an infantry rifle, passed at *I*, between wires which were covered with glass tubing, the breaking of the tubing releasing the spark at *H*, just as the shot passed in front of the lens. The result was a sharp image of the projectile, of the electrodes at *I*, and of the spark.

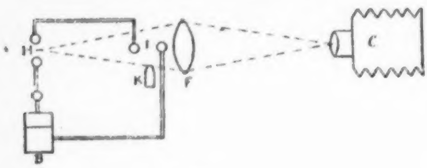


FIG. 3.

When the velocity of the projectile was sufficiently high, the wave disturbances in the air were impressed upon the plate in the camera quite distinctly. Of course, the actual waves themselves could not be photographed, but the changes in the refractive power of the air, due to the variations in the density, showed themselves in the form of lines and clouds which confirmed fully the correctness of the foregoing theoretical deductions.

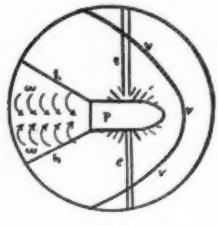


FIG. 4.

About 80 photographs were taken at different velocities, showing a variety of interesting details. In Fig. 4 is shown the general appearance of the photographs; *p-p*, is the projectile, *e-e*, the electrodes, *v-v*, the front wave, *h-h*, the rear waves, and *w-w*, the whirls. The distance of the spark *H* from the objective *F* was about 18″, and from the objective *F* to the camera *C* about 7 feet, while the muzzle of the rifle was about 16 feet from the point *I*. The lens at *F* was an objective by Voigtländer, and the photographic lens in the camera was made by Steinheil.

Photolithographic reproductions of some of the photographs may be found in the proceedings of the U. S. Naval Institute at Annapolis, together with much interesting matter upon the subject.

HENRY HARRISON SUPLEE.

THE ORIGIN AND TECHNOLOGY OF PHOTOGRAPHIC CHEMICALS.

Twelfth Paper.—Acetic Acid and Acetates.

THERE are three sources of the acetic acid of trade—"cider vinegar," "sugar" "alcoholic acetic acid," and "wood" or pyroligneous acid.

Cider vinegar is made by distilling solutions containing dilute alcohol, such as cider, wine, etc., after undergoing a process of oxidation. In Germany acetic acid is made by mixing alcohol with water, eight of alcohol to ninety-two of water, and then pouring upon beech wood shavings. Trickling through, it is oxidized by contact with the air, aldehyde and other products accompanying the resultant acetic acid. The pure acid is made from the aqueous solution by very careful distillation. Owing to the very high tax on alcohol in this country, but little or no acid is made in this way here, and "cider vinegar" is doubtless seldom found in the shops, except that made from wood vinegar by admixtures of coloring and flavoring matter.

The usual acetic acid of commerce is the product resulting from the purification of the crude acetic acid obtained by the destructive distillation of wood. Wood

when charred yields many volatile products, among which are an acid liquor, an empyreumatic oil, tar containing creosote, methylic alcohol or "wood spirit," and some other proximate principles.

When the carbonization is carried on in closed vessels or stills, these products may be collected, and the unconsumed or undistilled portion yields a large quantity of the best charcoal.

This method of distillation was first practiced in France in an apparatus consisting of a furnace with a movable top, a sheet iron cylinder, standing upright and large enough to hold a cord of wood, with a tight cover, with a sheet iron tube connected with a copper tube plunging into a vessel containing water, and then by a vent to let volatile products pass back over the fire to be consumed.

The cylinder holding the wood is heated and carbonization commences, the volatile products distilling through the tube, the acid liquors and tar being condensed in the receiver, while the combustible gases which are not taken up by the water, aid in heating the still.

It is said 1600 lbs. of wood yield on an average about 300 lbs. of acid liquor. This is the crude pyroligneous acid, and is a dark brown liquid, with a suffocating smoky odor, consisting of acetic acid diluted with more or less water from the sap, but holding in solution chiefly tar and empyreumatic oil, wood spirit and some creosote.

In making this acid, naturally the greatest economy is reached by being as near the sources of the wood as possible, and nearly all the works are rough establishments in the forests. The pyroligneous distillate is saturated with "cream of lime," or slacked lime, acetate of lime forming in solution and the tarry matter settling out. The solution of acetate of lime is carefully separated and evaporated to dryness in large open iron kettles, with constant stirring, and thus producing the commercial "gray" or brown acetate of lime, which is used in making either pure acetic acid or acetate of soda.

The crude acetate of lime is packed in casks and shipped to the many manufacturers of acetic acid, who use thousands of tons of it in preparing acetic acid for making white lead, in dyeing and other arts, and for chemical use.

The acetate of lime or soda is mixed with the proper equivalent of sulphuric or hydrochloric acid in suitable vessels and subjected to heat, the acetic acid being set free and sulphate of lime forming. Great experience is required in this operation to avoid contamination with sulphuric acid and tarry matter, and repeated fractional separations are necessary.

The strength of the distilled acid is shown by its specific gravities, the maximum strength is 1.0735, and that of the glacial or crystallizable acidis 1.063. Up to 1.062 the density is pretty accurately determined by the specific gravity, but above this point two acids of different strength may apparently coincide; thus at 1.063 the acid may represent the very strong variety or one containing only 50 odd per cent. of such acid!

Acetic acid is a colorless, volatile, inflammable liquid with a sharp vinegar taste, but having an acetous, pungent, though not unrefreshing smell; it crystallizes when cooled to 34°, sp. gr. of 1.063, when properly in the form called "glacial" acid. It dissolves volatile oils, camphor, resins, fibrin, albumen, etc., and as it attracts moisture readily should be kept in tight bottles.

Photographic acetic acid is more dilute than the glacial, containing water as a solvent; is wholly volatilized by heat, and should yield no precipitate with chloride of barium or nitrate of silver; any fixed residue is an impurity, and precipitates with the above re-agents show the presence of sulphuric or hydrochloric acids. If traces of empyreumatic odor are present they can be detected by the smell, and if sulphurous acid or nitric acid or phosphate of soda are present they can readily be detected.

There is some difficulty in determining the exact strength of acetic acid solutions, as the acetates of soda and potash (the usual method of testing by saturating the acid with carbonates of these alkalies), though neutral in composition, are alkaline to test paper, and the liquid is alkaline to test paper while some free acid is contained.

Acetic acid in the crude state is a good preservative for animal food and wood fibre, and it is used for preserving rail-road ties and lumber by injection into the fibres by means of suitable pumping apparatus.

Acetate of soda is made by saturating *acetic acid* carefully with *carbonate of soda* filtration, and careful evaporation to a supersaturated solution, slowly cooling to form crystals, which are dried at low temperature. It is a white salt, crystallizing in long, striated prisms, with a sharp, bitterish taste. When these crystals are exposed to dry atmosphere they effloresce, and lose about 40 per cent. of their weight by loss of water of crystallization.

They are soluble in about three parts of cold water, and in a larger quantity of alcohol. They should be neutral or slightly acid to test paper, and be free from admixture with mineral salts. They contain 51 parts of acetic acid, 31.3 of soda, and 54 parts of water.

F. H. ROSENGARTEN.

THE PHOTOGRAPHIC SOCIETY OF PHILADELPHIA.

THE new rooms of the Society, at No. 1305 Arch street, were opened to the members for the first time at the stated meeting held on Wednesday evening, April 4th, 1888. The chair was occupied by the President, Mr. Frederic Graff.

The Secretary read letters from the Boston and St. Louis Camera Clubs, stating their action in regard to the Report of the Delegates to the Conference to organize the American Lantern Slide Interchange. The letters were referred to Mr. Wm. H. Rau, the representative of the Society in the Interchange.

The Committee on Membership reported the election of the following active members: Dr. Charles A. Oliver, and Messrs. Morris Earle and Thomas J. Yorke.

The death of Mr. Joseph Zentmayer, the distinguished optician, formerly an active and more recently an honorary member of the Society, was announced by Mr. John C. Browne, who offered the following resolution in regard thereto:

"The Photographic Society of Philadelphia, having heard with deep regret of "the death of Mr. Joseph Zentmayer, one of its honorary members, it is moved that "the following Minute be entered upon the Record Book of the Society, and a copy "of the same be transmitted to his family.

"The members of the Photographic Society of Philadelphia recognize in Mr. "Joseph Zentmayer a man of great ability in his profession, and honor his name for "what he has contributed to the improvement of the microscope, as well as to the pro- "duction of original forms of lenses employed in photography.

"They recall with pleasure the friendly, genial intercourse had with him, and "desire to express their appreciation of his extraordinary modesty in regard to his "own most valuable improvements in the optical instruments named."

Mr. Samuel Sartain and Mr. Frederic Graff added tributes of regret to the memory of Mr. Zentmayer, expressing their personal regard for him, and the resolution was passed unanimously.

Mr. Carbutt presented the Society with a lantern slide from a negative made by him at the last meeting in the old room, by the use of his Flash-Light Compound. The slide represented a large group of the members, and was remarkably successful, both technically and as an accurate portrait group of those present.

The Executive Committee reported the practical completion of their labors in regard to the new room, and presented the new quarters in a reasonably finished condition.

Some additions and alterations had been made to the furniture and a handsome new rug purchased for the floor.

A small room adjoining the meeting room had been fitted up as a dark room. The primary object of this room is to afford ample facilities for demonstrations before the Society, but the committee also desire that individual members of the Society have full and unrestricted use of this room for private work, if it can be demonstrated that this may be carried on without prejudice to the Society. To this end the committee have prepared regulations governing the use of the dark room by members.

Contributions in the way of outfit, etc., for the dark room had been made by Mr. John Carbutt, Messrs. W. H. Walmsley & Co., and T. H. McCollin & Co., which were duly acknowledged by the committee.

Dr. Mitchell stated that the Blair Camera Company stood ready to present to the Society, if desired, a complete camera for making lantern slides and enlargements. The generous offer was accepted, and a vote of thanks tendered to the Blair Company and the other firms and individuals who had contributed towards furnishing the new rooms.

Mr. W. H. Rau, representing the Lantern Slide Interchange, announced that slides from Chicago and St. Louis would be shown at the Conversational Meeting on April 18th.

Mr. Wood moved that the Executive Committee provide an album to contain portraits and autographs of members of the Society.

The motion being carried, Mr. Carbutt offered to present an album for the purpose, which was accepted with a vote of thanks.

The President appointed Dr. Ellerslie Wallace, and Messrs. Samuel Sartain and John G. Bullock, a committee to select the presentation picture for 1888.

Mr. Frederick E. Ives showed upon the screen a remarkable heliochromic reproduction of a natural landscape, produced by a method of his own, which is similiar in character to one suggested by Henry Collen, of England, in 1865. Mr. Ives stated that Collen's method, which Hauron, of Paris, first tried to reduce to practice, necessarily failed, because it was based on a false conception of the nature of light, and was an attempt to accomplish an impossibility. They assumed that there are three primary colors of light, and that the mixture of these in various proportions produces all the colors and shades of color in the spectrum. Their

plan, briefly stated, was to make a red picture by the action of red light, a yellow picture by the action of yellow light, and a blue picture by the action of blue light, and then to combine these pictures into one, showing the colors, as well as the light and shade of the object photographed. Mr. Ives explained that the color of no part of the spectrum could be reproduced by the optical combination of other parts, and no combination of three colors, simple or compound, could be made actually to reproduce the spectrum. The most that could be done was to combine three colors or pigments so as to counterfeit the spectrum to the eye. Mr. Ives' process was calculated to do this in such a scientific manner that each part of the spectrum must always select automatically, in the operation of the process, such a mixture of colors or pigments as would counterfeit it to the eye. Each of his negatives, instead of representing one part or color of the spectrum only, represented one small part exclusively, and several others partially, the degree of representation being graduated to secure the proper admixture of color or pigment in the resulting heliochrome. This was accomplished by employing color-sensitive plates in conjunction with compound color-screens, adjusted by actual experiment upon the spectrum itself. The actual composition of the color-screens would depend upon what color-sensitizers and what reproduction colors were employed. The process could be made to counterfeit all the colors of nature very successfully, and although it was too complicated and costly to admit of general application, he believed it had a bright commercial future.

For demonstration purposes, Mr. Ives employed the simplest form of the process, in which ordinary lantern slides from the heliochromic negatives were projected upon a screen by means of a triple optical lantern and colored lights, but stated that equally satisfactory reproductions could be obtained in pigments.

In the landscape shown, there were a white house, slate colored barn and fences, yellow straw stacks, green grass in the foreground, dark green trees in the middle distance (one showing a single bough of deep orange autumn leaves), and distant blue hills. The colors were surprisingly bright, and all approximately correct; but Mr. Ives stated that this result had been secured with a crude form of apparatus, and imperfect adjustment of color screws, and by no means represented the capabilities of the process. A fuller publication of the process will shortly appear in the *Journal of the Franklin Institute*.

At the conclusion of his remarks, Mr. Ives offered to loan to the Society such apparatus as might be necessary for experiments in Orthochromatic Photography, also to furnish emulsions, etc., and to conduct demonstrations of the various processes before the members.

On motion of Mr. Browne, a vote of thanks was tendered to Mr. Ives for his extremely interesting remarks and the wonderful results shown, and also for his kind offer for future aid in developing this new departure in photography in a practical way.

Mr. Carbutt quoted Mr. Ernest Edwards, of New York, as saying that Orthochromatic photography had enabled him to make reproductions of paintings, etc., which would have been utterly impossible before the recent discoveries in the art were made, and the process was in constant use by him.

Mr. Suplee showed an interesting series of figure studies, made by the use of Blitz-Pulver and Cramer 35 plates. He also showed some lantern slides from the

same negatives made on Carbutt's A plates with Blitz-Pulver as a source of light. A ground glass screen was placed 3 inches back of the negatives (5 in. by 8 in.) The powder being placed 6 inches back of the screen, forty grains or 2 charges were used, with a stop of about *f* 6 in the lens.

Some excellent slides were also shown by Mr. Stirling, and some by Mr. Wood, which illustrated in a marked manner the difference in results in landscape photography between the use of long and short focus lenses.

Mr. McCollin showed an improved form of ignitor for use with flash powder, conveniently arranged so as to pack into small space. The powder was ignited at the instant required by the flame of an alcohol lamp being blown against it by a current of air produced with a rubber bulb and flexible tube. After the meeting, Mr. McCollin illustrated the use of the apparatus by making several portrait groups of the members present amid their new surroundings.

Adjourned. ROBERT S. REDFIELD,
Secretary.

THE PRESENT VALUE OF ART IN PHOTOGRAPHY.

Read at the London Camera Club Conference.

THE subject I have chosen for my paper to-day is one very important to the photographic public, one upon which I would see the attention of the photographic world more firmly riveted, but one, I am glad to think, daily enlisting new advocates in its cause, and becoming more and more present as a question of the day in the minds of us who are eager to advance the art side of photography.

I cannot, in the brief time necessarily allotted to each of us, hope to go deeply into the present state of art as existing in modern photography, neither am I anxious to force my own personal views upon photographers at large; but I do wish, by an appeal to those present, with a brief outline of existing things as seen from my own point of view, to sow a small seed that may take root and grow in the minds of many; to place, as it were, a closed casket upon the table of our conference, that those assembled may, by their united wisdom, seek and find the secret of its opening. To be more prosaic: I would bring forward the subject, I would quietly state my thoughts—thoughts that have been present in my own mind for many years,—asking every one to contribute his share of thought and labor, thus gaining the advantage of many witnesses.

Photography has increased so enormously of late years that I believe it true to say no home exists in the kingdom, rich or poor, but has beneath its roof a photograph of some kind.

Let us consider what this signifies. It is this: in every household a means exists, be it ever so small, of appealing through the eye to the higher instincts of the human being; of touching through the natural affections the tenderest feelings of the human heart; or, should the picture be a landscape, by leading the mind to some quiet spot of God's nature, of shedding a spirit of peace over the soul, freeing it awhile from the narrowness of the every-day world, and raising it with thoughts that are the truest, purest, and most beneficial worship of the Creator Himself.

What power have we, who are able, through our circumstances, to give thought and time to this our art science? How much might we not do for our poorer brethren

by instilling into photography a spirit of pure art, by raising in them a mere reflection even of some of the thoughts and feelings experienced by ourselves when contemplating Nature, or the thoughts and works of the greater artists? Alas! I have no space to treat of the effect of art upon the human temperament. I may only say enough to show that the power lies in all branches of pictorial art.

It is my opinion—I grieve to say it—that photography, as at present practiced, has a very slight art value, such value as it does possess lying among a very small number of the chief professional men, and among amateurs—the latter's portion of merit being more or less in landscape work; and yet it is my hope some day to see the simplest picture possess, at least, the merit of correct art, that is to say, as far as the mere mechanical rules are concerned.

Suppose we were to pass through the streets of London as strangers, almost the first thing to catch our attention would be the show-case outside some photographer's studio; at a short distance it appears to be a collection of pretty pictures, and we are filled with delight. Approaching near, the dream is dispelled—it was distance that lent enchantment to the view. Here is a head carefully vignetted, a clear, good photograph, well finished, save, perhaps, that it has been made unnatural through excessive retouching; there has been no figure to pose, hence composition faults are at their minimum, and, excepting a slight stiffness, the whole is very pleasing.

Here again is a figure standing by a chair—a full-length figure; the picture is good, but something in it makes it unpleasant to the eye. A few moments consideration, and we realize that the complete figure is placed wrongly in the picture, the space on either side wrongly apportioned, the line of the chair in crude composition, out of harmony with the chief subject, adding to the annoyance caused by the other faults.

Then again, we find many a picture of a lady half reclining, half sitting upon a sofa, where the lady herself is but an accessory, the sofa being so crudely introduced, and its lines so inharmoniously composed with those of the subject, that it becomes the centre of attraction, and forces itself upon the eye to the exclusion of the chief object.

This is composition as to lines. For light and shade we generally should find a better state of things, although we rarely see what may be felt and known as a beautiful arrangement—one that draws and keeps our attention fixed. I have no space here, neither would the time be suitable to attempt a lecture on composition and light and shade, nor do I presume to teach. I desire rather to tell you what I would wish to see, what I would have learned.

Photographers as a class cannot progress, neither can their art thrive by mere technical excellence; that is but a minor detail, though a necessary and very important one. Could the higher arts thrive or be anything with mere excellence in the technicality of coloring? You will all say no! and I reply, neither can our art thrive, I had almost said live, without a vast deal more than technical excellence. The picture is the main, the most important thing, and without a true knowledge of the laws of art there can be no picture worthy of the name. Here and there we find work showing the love and tenderness for what is complete and beautiful, from which a deeper knowledge of art so readily springs, but I fear it is only here and there.

How constantly, on the other hand, does one turn away disgusted from pictures

without one jot of feeling; from portraits in which the different parts of the figure express in their attitudes thoughts and ideas that are at variance?

I would see that deeper knowledge everywhere. I would see such a state of things that when a man or woman asked for a photograph he or she received a picture—a picture only in light and shade, but still a picture as to composition, and complete as a whole.

Have we not art schools? Have we not collections where everyone whose path in life is upon the high road of pictorial art may study, and so bring completer knowledge to bear upon their work? It is as easy and profitable to produce what is correct and beautiful as to manufacture what is bad. The process (in photography at least) is just as cheap.

The public—I do not deny it—are satisfied with what they now receive, because they cannot judge, and because they only wish for a recollection from life of places and people dear to them; and also because "it's only a photograph."

Should the painter's art stand still (and standing still is recession) because the public are ready and willing to buy the thousands of bad pictures exhibited yearly in our exhibitions? Do not the leaders in the painters' world work on and win authority and renown, and so teach what is right from the place they have won? Do not our galleries of masters' works live as standards which none dare dispute? And why should not we, in our lowly branch of art, have our standards, our ideals? I have looked abroad in vain, I have hoped in vain; but I can find no soul, no ideal in photography. Every man does as he thinks right, obeys no or few laws, works to no standards.

I have fancied that a dawn of better things was breaking, or about to break, and I hope still.

There is a movement among amateurs to raise standards; let them study, let them strive and labor, and so make the science that has well nigh reached perfection to be a vehicle of true art; and let us realize what this means. When we think how easily obtainable are photographs by all ranks and classes, and how widespread is their circulation, we can then see how important a thing it is that every photograph be pictorially valuable.

I have said my say; and in so doing have endeavored to keep strictly to my subject, resisting the temptation to stray in the many by-paths opened out. If I have expressed myself too strongly I would be pardoned, for I have but spoken my own thoughts, feelings, and experiences, and have but shown that earnestness of wish I would see in all, both professional and amateur—indeed, I acknowledge no distinction, as all are brothers who really love their art, and thus I claim a brother's right to speak my mind. Let others labor, let all labor separately, according to their several leadings, and in unison, to raise and increase the present value of art in photography.

J. F. MOSTYN CLARKE.

THE PHOTO-ENGRAVING COMPANY, of New York, sends us a number of beautiful examples of their processes—photo-engraving, photo-zinc etching, and halftone work.

THE THEORETICAL ASPECT OF ORTHO-CHROMATIC PHOTOGRAPHY.

Read before the Conference of the Camera Club.

LAST year at the Conference I gave some practical examples of ortho-chromatic photography, and this year I propose to deal with its theory.

Let me first briefly touch on the methods by which an ortho-chromatic plate is prepared. It may be taken that for a plate to be ortho-chromatic we must have a salt of silver in contact with a dye of some description. Such a dye may be combined with a silver salt, or it may be uncombined. Further, we may take it as an axiom that in the latter case, unless the dye is a fugitive dye, no action will take place. Also, it may be taken as another axiom that only those rays which are absorbed by the dye (or the silver salt formed by it) and by the haloid silver salts (the bromide, chloride, and iodide), have any chemical action on the dyed film. For, as I have often laid down before, no work can be done by radiations unless there is absorbtion, and that work done may be heating, or chemical action.

When Dr. Vogel first announced the fact that a dye added to a sensitive silver salt made the plate sensitive to those rays which the dye absorbed, the old collodion days were in full swing, and gelatine emulsion was unknown. The nitrate of silver bath was employed, and also collodion emulsions. In those days, apparently, Dr. Vogel found (according to a communication which appeared in the *Photographic News* for April 26, 1876), that, in order for dyes to be effective, the silver-nitrate ought to be in slight excess. In trying plates in which there was a slight excess of soluble chloride he was surprised to find "that solutions of naphthalin red, or cyanised (cyanin) gave *not a trace of* action in the yellow or red on exposing them to the spectrum, whilst bath-plates colored in exactly the same way gave action in the same time; for instance, yellow and red stronger than the action in the blue of the spectrum." And again, in the same year, on May 5, he says, "Further investigations have confirmed the opinion given in my last letter, that dyes like Magdala red and cyanin make the bromide of silver sensitive to the yellow and orange rays only in the presence of a trace of free nitrate of silver, or any other suitable sensitizer, as tannin, morphia, etc.

Now, let us see what are all the possible ways in which a dye can effect a silver salt, taking it that the dye, or its compound of silver, is only acted upon where it absorbs in the spectrum, and that the subsequent special action on the silver salt is confined to this locality. If a dye chemically combined with a silver salt, as we know that some do with silver nitrate, as I pointed out in the *Photographic News* of 1876, then the matter is straightforward enough. Light will act on it, as it does on any other organic salt of silver. There may be another combination, however, between a dye and a salt of silver which is in the solid salt to form a double salt; or there may be a mechanical combination, such as takes place between alumina and a dye, in other words, the formation of a lake. So far as we know, this last combination is not a chemical one, but a mechanical one, though the molecules of each are very close to one another, There is, however, no interchange of atoms which there is in a chemical combination. Each is still a separate substance, although in such close contact. Now, when silver bromide is formed in gelatine or collodion in which the dye is present, the precipitation of a portion of the dye may take place on the same principle as

it may when a film is dyed by immersing the plate in a solution of the dye. We have in this case a more difficult business to deal with in tracing the action of light on such a dye than we have when the combination is a chemical one. Many of the dyes are fluorescent, and if the fluorescent light was of shorter wave-length than the rays producing it, then we might trace the action to these short waves of light which would lie nearer the violet end of the spectrum than those producing them.

Stokes' law tells us, however, that there is a degradation of wave-length, and that the waves of light are increased in length, and not shortened. Hence this explanation fails. Again, too, some dyes are impressionable which are not fluorescent at all.

Next the action may be on the dye alone, and the dye, as I have said, may form a nucleus for development. The dye may be acted upon, and the reduced or altered dye being in contact with the silver salt may partially reduce the silver salt by its contact with it, much in the same way that alkaline pyrogallic acid chemically reduces a salt of silver. In other words, the dye in its unacted-upon state is inert, but when acted upon becomes what may be termed a developer. The amount of "developer" in this case must be so minute that the change in the silver salt would be indistinguishable. But it must be recollected than an infinitesimal amount of reduced silver would be quite sufficient to act as a nucleus on which development can start.* When an emulsion is formed in gelatine, ammonia being present, it is asserted that the action of the dye is much greater. The fact that ammonia† accelerates the action of the dye in many cases gives a color to the developing action being a possible, and I may say probable, action.

It must be borne in mind that the chloride and bromide of silver both absorb ammonia in a very marked manner, and that even after washing they will hold it to some extent. The alkalinity of the salt, then, is favorable to this developing action.

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* Since I wrote this part of the paper I have been somewhat surprised to find that I enunciated the above in a very definite form some six years ago. In my Cantor Lectures at the Society of Arts, in 1882, I said:—If you take one of those aniline dyes, such as blue dye, and expose it to light behind a piece of black paper, with an aperture in it, such as I have here, you get an image on the dye, such as you see. What is the meaning of that? The meaning is that the dye is oxidized, for if you apply an oxidizing agent you get the same result. Dr. Vogel found that if you dyed plates with some of these fugitive dyes—they were all fugitive to great extent which he used—he was able to obtain an extension of the impressed spectrum exactly in those parts of which the dyes absorbed, and he introduced the term optical sensitizer to describe the fact. Now, I am going to quarrel with that expression, because he explains it in this way: He says, in effect, that the sensitive aniline dye is able to take up a vibration, and to direct it to something else. In other words, that when light has done all it can in endeavoring to bleach a dye, that its period is transformed, and it does something else on the silver salt which is in contact with it. Well, that is not a philosophical way of looking at things, because if you could only arrive at the principle, you might just as easily arrive at that principle of perpetual motion, which is a thing I am not prepared to admit. Now, I honestly say that for a long time these experiments staggered me, and the arguments Dr. Vogel brought forward seemed fully to justify his term of optical sensitizer as applied to the dye stuff; but eventually I was able to come to a different conclusion, and that conclusion I wish to put before you. If you have a substance which is oxidized in the presence of an haloid salt of silver, what do you expect? You expect that the haloid salt of silver would be reduced. If you place pyrogallic acid in contact with the haloid salt of silver, and help it to be oxidized by ammonia, you expect that the haloid salt of silver will be reduced, and I lay the action of the dye to precisely the same principle as the pyrogallic acid, which helps to develop the image; in other words, the oxidation of the dye causes a reduction of the bromide of silver, or iodide of silver, as the case may be, and simply provides a nucleus on which development can take place. I wish, however, to point out that Dr. Vogel has an objection to my explanation. He says, "Oh, but you require time to bleach things; you require time to alter them." So you do; you require time to blacken the chloride of silver; nevertheless, the slightest exposure to light begins the change in it, and so the slightest exposure to light begins the change in the dye, and on this principle, of course, the action of dyes upon sensitive films can readily be explained.

† Eder found that the alkalies and carbonates of the alkalies did not increase sensitiveness. In a dried plate these take crystalline forms, and can in no way be compared for efficiency with ammonia (NH_3.)

There is no other method which I can conceive possible.

Mr. Bothamley has, in an interesting paper, which he communicated to the Society of Chemical Industry, given a capital *résumé* of Dr. Eder's opinion as to the action of light on a dye. This excellent experimentalist considers (so says Mr. Bothamley) "that the dye unites with the silver bromide to form a molecular compound of the nature of a lake. [As we have said, this is quite possible.] The action of light on the dye and the silver bromide is simultaneous. The compound of the bromide and the dye absorbs the light rays, and the energy which existed as wave motion is communicated to the molecules of the compound. The molecules are thereby thrown into such energetic vibration that their equilibrium is disturbed, and the silver bromide is either decomposed into bromide and silver sub-bromide, or is brought into that state of unstable equilibrium in which it is readily acted upon by a reducing agent such as constitutes an ordinary developer. When the light rays are absorbed by the dye alone, the waves for the most part undergo *photo-thermal extinction*, and their energy is transformed into heat, a small proportion undergoing *photo-chemical extinction*, and being used up in producing chemical decomposition, since the majority of dyes are slightly altered by light. When, however, the rays are absorbed by the dyed silver bromide, the greater part of the waves undergo photo-chemical extinction, and their energy is used up in decomposing the silver bromide, whilst only a small portion undergoes photo-thermal extinction."

I should like to make a few remarks on this explanation.

Radiation (or light, if you like to call it so) consists of undulations which are capable of doing work of some kind on a body on which it falls. The work may be heating the body on which it falls by the absorption of rays, or chemical action by decomposing such a body, or both. This is what is translated as photo-thermal extinction and chemical extinction. Now, from the above it is evident that the dye is considered first to receive the light, and we are told that by itself we have plenty of photo-thermal extinction (or heating of the body), and a little photo-chemical extinction (or chemical decomposition of the body); but directly the dye is in contact with the bromide, the two extinctions are reversed, and that chemical action is in the ascendant, and the silver bromide is decomposed. In other words, it comes to this, that the heating of the dye—for mark that the dye not being chemically combined with the bromide, the work done in it must be identical with that which would be done were it not in contact with the bromide—does chemical work in the bromide of silver. If this were the case, a hot iron applied to the back of the plate should be quite as effective. If the silver was a real chemical compound with the dye, such an explanation, with modifications, might be the case; but you are not dealing with a chemical compound in the case of a lake, but only with a mechanical compound—a very widely different thing. It is for this reason that I cannot accept this explanation.

Let us now see what would happen with various salts of silver should my theory be correct. I put on one side what would happen if the dye combines with nitrate of silver, or with the haloid salts; since then, the action is more probably the same action as that we have on ordinary organic salts of silver, viz., a reduction to a lower form of saturation, what I shall turn my attention to, is simply what we should expect to find if the dye acted as a developer.

1. Supposing all the salts (without the contact of dye) had the same range of

sensitiveness to the spectrum, we should expect that those salts which were most readily amenable to alkaline development should show most reduction by the dye in the parts of the spectrum where the dye absorbed, since in that part the dye would become reduced. The order of the haloid silver salts would then be (1) *chloride*, (2) *bromide*, (3) *iodide*.

2. If one salt of silver be more sensitive (without the dye) than another to that part of the spectrum where the dye absorbs; and if we suppose that all the sensitive salts were equally amenable to alkaline development, we should expect that the most marked effect would be on that salt which is most sensitive to that particular part of the spectrum, since the action of the dye would be supplemented by the action on the haloid salt. The order would then be (1) *bromide*, (2) *chloride*, (3) *iodide*, for the two dyes I shall consider.

Suppose we put supposititious values to them, thus:—

	Relative facility of reduction by alkaline developer.	Relative sensitiveness to part of the spectrum which the dye absorbs.
Chloride	10	2
Bromide	5	10
Iodide	1	0

We should, by adding one number to the other for each salt, gain an approximate idea of the relative intensities we should have caused by the dye and the silver salt to either. Putting them in order we should have:

Bromide	15
Chloride	12
Iodide	1

That is, the dye should have 15 times as much effect on the bromide as on the iodide, and 1¼ times as much effect as on the chloride. Of course, here it is supposed that the exposure given is that necessary to bring out the part of maximum action on the undyed salts to the same density of development.

Further, if the silver salt was in contact with soluble bromide or chloride as well as the dye, we should, as in the case of akaline development, expect the developing action of the dye to be retarded, the soluble bromide and chloride forming double salts with the bromide and chloride of silver. This is just what Vogel found in 1876 as I have already quoted.

Now, Eder and other experimenters have found, as I have found, that the action of dyes is quite different with the different salts of silver, and this development or nucleus theory fully accounts for this on the above grounds. Eder's theory, just quoted, will not explain the action, I think; nor will the theory which I understand as that of "optical sensitizers."

In reference to the chemical action of light on dyes, I would recall some experiments, published in the *Photographic News* and elsewhere, made several years ago by Dr. Minchin. He coated metallic silver and platinum plates with dyes, and made them the plates of a cell, and connected a galvanometer with them. He found that when light fell on the dyed plate a current was caused to flow in a certain direction, proving that a chemical action took place in the dye, and not a heating effect. Becquerel many years ago proved that a current was produced when it fell on chloride of silver, with which one plate of a similar cell was coated. In other words, electrical action was shown by the chemical decomposition of the compound in contact with

one of the plates. I myself at one time thought of reading a paper on this subject to the Conference, giving an account of the various experiments which I had made some three years ago, and more on an extension of this method. I have not had time to collect all the results of my experiments in an orderly shape, so have deferred giving them till a more convenient time. I may say, however, that all my experiments point to the action of light on a dye being always largely chemical. I will give two or three extracts from my note-book. On the surface of a silver plate chloride was produced. An exposure to white light of this, as one of the pairs of plates in a cell, produced a deflection of the galvanometer needle;—through yellow glass none. The plate was removed and coated with a film containing eosine. White light produced a deflection, and through yellow glass there was also a deflection. Eosine alone on the plate, when exposed to the yellow light, gave a deflection of the galvanometer needle. This showed that a chemical action took place in the green, no matter whether the chloride was there or not.

I have thus cleared the ground to some extent for what I propose to say on the theory of the subject. The experiments which I shall describe to-day will be confined to two typical dyes, erythrosin and cyanin. The one combines readily with silver nitrate, and the other combines very feebly if at all with that same salt. It has been stated recently by Dr. Vogel that he considers dyes are optical sensitizers, and to use his own words, "a ray absorbed by certain dyes in the presence of silver salts acts more vigorously on this salt than non-absorbed rays." My reading of this was that the ray if not absorbed would do less work than the same ray which was absorbed by the dye. Now on turning over this sentence once again, I see it may mean that the ray absorbed by the dye acts more vigorously on the silver salt than other rays which are not absorbed by it. If this is his meaning, I tender my apology to him for an unintentional misrepresentation, and I agree with him in this sense.

I will commence by describing my experiments with cyanine. Cyanine is a most unstable compound. In solution, it will bleach in daylight, and even in the dark the color would be discharged by almost imperceptible emanations. If a plate be coated with collodion containing it, together with a soluble haloid salt, and be immersed in the silver bath and exposed, on applying the ordinary wet plate developer to it we get a general fog over the plate. Even when using a dry plate, and developing with the organic salts of iron, fog is very often induced. So, too, it is found that a gelatine plate, if dyed with cyanine, will not keep long; fog is induced. The fog means that, even in the dark, the dye unaltered by light has a tendency to bring about an initial reduction of the silver salt; much more may it be supposed that the dye when altered by light will do the same thing.

First, I repeated an old experiment of mine, which was to tint a plain collodion film with cyanine blue, and to expose it in the spectrum, and then in the dark room, to coat it with collodio-bromide emulsion and to apply the developer. The plate had bleached in the orange of the spectrum, and on applying the developer an image appeared, or rather silver was deposited where the light had acted on the dye. In this case the emulsion had an excess of bromide that was well washed out. From this it appeared that since the silver salt had never seen light, a reducing action was caused by its subsequent contact with the bleached dye.

I next prepared collodio-chloride emulsions, one with an excess of silver nitrate,

and another with an excess of calcium chloride. Plates coated with both of these were exposed in the spectrum so as to print, a wideish slit being used in the spectroscope. As the results in this case were identical (except that the printing was rather more rapid with the former emulsion than with the latter), I may give one description for both. The plates showed in the violet of the spectrum the usual purple tint of the reduced chloride, the color being much fainter in the blue. In the green was no action whatever; whilst in the orange we had a distinct bleaching. Now, if the silver salt in contact with the cyanine were reduced in the same way in the orange that it is in the violet, there should have been besides a bleaching a darkening, but this was not the case; the chloride was apparently free from any sign of reduction. Similar plates were exposed for a shorter time to the spectrum and developed with ferrous citro-oxalate developer, with the result that in the case of the emulsion in which the silver nitrate was in slight excess, the orange band developed as strongly as the violet; whilst with that in which the soluble chloride was in slight excess, the band developed in the orange was less intense than that in the violet. Now, on comparing the printing action with the developing action, the deduction that is to be drawn is that the action of the orange light was principally on the *dye*, and not on the silver salt, only the small portion in contact with the silver acting as a developer, and that the nucleus was of a stronger type than that of the mere chloride, which would be the case if it were metallic silver that was formed.

Taking a gelatine chloride film and dyeing it with neutral cyanin blue, the printing action was likewise observed. In this case the sensitiveness of the chloride extends further in the spectrum towards the yellow from the blue end than when collodion is used, but the same result was obtained as before. The chloride was bleached in the orange, with a very slight darkening, and in the violet, the blue, and slightly in the green the chloride was darkened. On developing a plate of the same kind, with a less exposure, the orange band developed up with nearly the same intensity as the violet. The same argument applies in this case as with the collodion films. Now, to make matters still more certain, a new experiment was tried, and one which proved highly suggestive. A chloride gelatine plate was coated with *plain* collodion, which had been slightly tinted with cyanine blue and was then dried. The plate was given a brief exposure to the spectrum and developed after softening the collodion film by means of alcohol. The plate developed up with a band in orange very fairly strong. The cyanine was in this case only *in close contact* with the gelatine surface. Next a similar plate was prepared, and after exposure and before development, the collodion film was removed after thorough softening. The plate was then developed, with the result that there was a marked band of reduction in the orange, though not quite so strong; hence the removal of the film resulted in the partial removal of the cause of reduction. When ammonia was present with the cyanine, the band appeared strongly. In these last experiments, it was endeavored to remove all trace of the film containing the cyanine, which was a difficult matter in a dimly-lighted room, and many failures occurred. The reduced cyanine in the film thus acted to form a nucleus of reduced silver for development.

Negative varnish was dyed with cyanine, and a gelatino-chloride plate coated with it, with the result that after exposure in the spectrum the same action was mani-

fested; on a complete removal of the varnish from a similar film, and after a careful washing of the plate, the orange band was visible. It was evident that it was the last trace of the dye in surface contact with the sensitive salt which was productive of the ortho-chromatic effect.

A plate was next coated with collodio-bromide emulsion which had been dyed with cyanine, and after exposure it was developed, after softening the collodion film well in alcohol. On removal of the collodion film on which the orange band appeared, the image of the violet and orange band was strongly shown on the gelatine plate. A similar plate was exposed and the collodion film first removed; on development, it was found that the orange band was rather weaker on the gelatine film than with the first plate.

Another experiment was as follows: A gelatino-chloride plate was taken, coated with collodion, dyed with cyanine, and exposed. The color of the dye was then removed by immersion in an alcoholic solution of sulphurous acid. This experiment showed that whilst the image in the blue and violet was developable, the band in the orange refused to show any trace of existence. This may have been due to the removal of reduced silver salt as well. The sulphurous acid would naturally attack the surface particles first. Next a gelatino-chloride plate, which had been dyed throughout with cyanine, was immersed in sulphurous acid, after exposure in the spectrum. The band in the orange did in this case appear, but more feebly. It was found that the dye was not discharged completely. These experiments have to be repeated, however.

So far, then, the conclusion must be drawn that the dye itself is reduced, and acts as what we may call a developer of the silver salt.

(To be continued.)

DEPTH OF FOCUS AND DIFFUSION OF FOCUS AND FLATNESS OF FIELD IN LENSES.

AT a recent meeting of the Photographic Society of Great Britain, Mr. J. R. Dallmeyer read a paper entitled "Depth of Focus and Diffusion of Focus," portions of which we extract, together with the discussion which followed, from the report printed in *Photographic News*.

Perfect depth of focus, he said, was only possible with a pinhole camera. With a lens perfectly corrected absolute depth of focus did not exist. According to the law of conjugate foci, an image of a subject in one plane being rendered on to a given point, an object on any other plane would be rendered on some other plane than that on which the first object would be in focus. It was an impossibility to focus on one plane two points which were on different planes. There was, however, a limit of want of sharpness, within which the image was practically sharp, and that limit was a circle of confusion of one-hundredth of an inch in diameter. It was possible, therefore, by a calculation (which he illustrated on the blackboard) to calculate what must be the size of the diaphragm or aperture to insure, with a lens of given focal length and with objects at given distances, that the circle of confusion should not exceed the limit which had been referred to. One of the formulæ on the board had been published some year or so ago by Sir David Salomons; and from it, it was apparent that

depth of focus can only be obtained by diminished aperture. The general formula would be better to look through at leisure. It would be evident from what had been shown that it was absurd to speak of some lenses having more depth of focus than others. As to diffusion of focus, a pinhole camera gave diffusion of focus with uniform depth of focus; the picture was produced throughout by small circles of confusion. Diffusion of focus was obtained by the introduction of positive spherical aberration, and this was of practical utility; but for a lens to be practically useful, this power of introducing spherical aberration must be under the command of the photographer, and this was achieved by means of separating the elements of the back combination as much or as little as might be desired. In portraiture, if you use a perfectly-corrected lens, you obtain sharpness in one plane, and want of sharpness in others; whereas, by introducing a certain amount of positive spherical aberration, you have similar circles of confusion and a general softness, whilst in the former case there is a lack of harmony.

W. E. Debenham said that it was sometimes as useful to expose or refute a fallacy as to proclaim a new fact. There was and had been a fallacy current amongst photographers as to the supposed property of some lenses of having depth of focus. He thought that it should be generally known that depth of focus was not a function of the lens at all, but of the aperture. Some twenty-one years since, the late Mr. J. H. Dallmeyer, in bringing before this society the lens with the means of bringing in spherical aberration at will, had claimed that he thus obtained better definition in the planes out of focus, not only relatively, but absolutely. That claim had been refuted by the late Thomas Grubb, in a paper and diagram which appeared in the *British Journal of Photography* on February 8th, 1867. It was there shown that by introducing spherical aberration the definition was lowered throughout. He believed that no attempt had been made to answer or call in question Mr. Grubb's demonstration. He wished photographers to know the fact that by sacrificing definition at the focus they did not obtain better definition elsewhere, but the contrary. If, knowing this, they were contented to put up with less definition everywhere for the sake of getting rid of sharpness at the focus, that was a matter for their own consideration. He was glad that it was no longer claimed that better definition in the out-of-focus planes resulted from giving up fine definition at the focus, but he went further, and maintained with Grubb that the definition was injured throughout. He concluded by giving an extract from Grubb's paper: "In short, in whatever way we make these comparative measurements, provided it be done fairly, we shall find the advantage with respect to depth of focus to be on the side of the corrected lens."

G. L. Addenbrook would like to explain what he understood by depth of focus, that with some lenses the definition was only good in the centre of the field, with others there was definition within the limit of one-hundredth of an inch, which was considered permissible, at some distance from the centre.

W. E. Debenham observed that that was not a question of depth of focus, but of curvature of field, or of astigmatism.

T. Sebastian Davis said that definition had much to do with curvature of field. In the early days of photography opticians sedulously endeavored to obtain the utmost sharpness at one point. Dallmeyer, however, brought about the diffusion of focus over an approximately flat field by the introduction of a negative lens between the

positive lenses, and this was the triplet. He desired to bring the subject forward for the special purpose of mentioning that he had lately been using two lenses for transparency work in the camera. One was the 2B lens by Dallmeyer, and with this he could work satisfactorily, and obtain definition at the margin of the picture; whereas, with another lens by the same maker, made expressly for transparency work with the lantern, and possessing no color to interfere with the display of slides, he could not get satisfactory definition at the margin.

Sir David Salomons said the calculations for depth of focus could all be obtained from the second formula given by Mr. Dallmeyer, which was the one he had published. He did not at all agree with Mr. Dallmeyer that diffusion of focus was an advantage. The moment he got any amount of diffusion, something appeared which he did not like. He, therefore, when using the lens which would give diffusion when unscrewed, always screwed it up to the position of perfect definition. The only successful way for large heads was the old way of moving the lens backwards and forwards. It had been objected that by this means the size of the image was altered, but he had not found this to be sufficient in amount to be practically injurious, and he obtained microscopic definition of both nose and ear. There was, however, he believed, a way of moving the components of the lens, so that the image would remain of the same size, although the focal plane was altered. He hoped shortly to read a paper on the subject.

V. Blanchard would not attempt to go into the optics of the subject, which he did not understand, but would deal with lenses as instruments for producing artistic effects. He considered that there was an immense difference in lenses in the power of giving depth of focus. Many years since he worked with a single lens, which was, in fact, the front lens of a French portrait combination, and obtained the results that he wanted. He showed the lens to the late Mr. Dallmeyer, who observed that the tube was evidently long enough to act as a stop. He objected to the painful sharpness which a perfectly-corrected lens gave, and he and the late T. R. Williams asked Mr. Dallmeyer whether he could not construct such a lens as they required, and the result was the lens which had been referred to that evening, and which for five-inch heads he used with the diffusion arrangement screwed out to the utmost.

J. R. Dallmeyer, replying, said that with the exception of Mr. Debenham and Mr. Blanchard, the discussion had seemed to turn rather on flatness of field than on depth of focus. One point that seemed to have escaped notice was that the lens to which he had referred will give perfect definition when screwed home, and that the diffusion of focus can be introduced and regulated at the will of the operator. As to Mr. Debenham's quotation from Mr. Grubb, he did not enter into that question. As to the relative advantage of moving the lens and introducing spherical aberration, with the latter there was a sharp point surrounded by a halo, which gave softness. The halos ran into one another, and so produced softness.

TEMPLES AND TOMBS IN INDIA.

INDIA is prolific of subjects for the camera. To do it justice would be an utter impossibility, the few subjects shown may be likened to a faint line in an etching, to make a suggestion and require the beholder to complete the idea and imagine

the great possibilities. It was my fortune a few years ago to spend several months in India, and while there to secure some of the choice bits in scenery and architecture. The Royal Botanical Gardens at Calcutta, situated on the banks of the Hooghly River, about 5 miles below and on the opposite bank from the city, contain many remarkable specimens of tropical plants, the chief object of interest being the great Banyan tree, whose far-reaching branches cover a space of upwards of 5,000 square feet. Leading to this wonderful growth is the avenue of Sago Palms. The smooth symmetrical trunks of these trees reaching to a height of 40 to 50 feet, there bursting into a tuft of graceful leaves, bordering as they do a road nearly one-half a mile in length, form an avenue the beauty of which can hardly be underestimated.

Of the interior cities, Agra, no doubt, contains the finest specimens of the handiwork of the Mogul architects. If there were nothing else, to say that the Taj Mahal was within its confines would be sufficient to make it the Mecca of all lovers of the truly beautiful. It has been aptly called a "poem in marble," and when seen from the Palace of Akbar, in Agra Fort, framed by an archway of marble and resting in its bed of luxuriant tropical foliage, with the winding Jumna close at hand, it is indeed the brightest jewel of the "Gorgeous East." No pen description can do justice to this marvel of architectural beauty, of which Bayard Taylor says, "The Taj truly is, as I have already said, a poem. It is not only a pure architectural type, but also a creation which satisfies the imagination, because its characteristic is Beauty. . . . . . When seen from a distance, so like a fabric of mist and sunbeams, with its great dome soaring up, a silvery bubble about to burst in the sun, that even after you have touched it, and climbed to its summit, you almost doubt its reality. The four minarets which surround it are perfect—no other epithet will describe them."

Within the city of Agra the chief attraction is the fort built by Emperor Akbar, about the year 1560. It is entered on the southern side, through a magnificent portal know as the Elephant Gate. The large octagonal tower overlooking the moat and commanding the entrance, gives the fortress an air of impregnability that is truly imposing. To the modern eye, the beautiful architecture and elaborate ornamentation of the fort seem out of place, yet the great Mogul had an eye to the beautiful as well as the useful, and while it is pleasing to look upon, it is a marvel of strength and security. After passing through the Elephant Gate, the visitor is shown the famous Moti Musjid or Pearl Mosque, as it is poetically and justly termed. It was built during the reign of Shah Jehan, and while of comparatively small dimensions is absolutely perfect in form and proportions. Such is the elaborate finish of this building that it is estimated to have cost 3 lakhs of rupees ($1,200,000.) It, like the Taj, is constructed of white marble, which, under the fierce Indian sun, is bleached to a dazzling whiteness. The three domes surmount a deep corridor, open toward the east, and divided into three aisles by a triple row of the most exquisitely-proportioned Saracenic arches.

The town of Akbar is situated at Secundra, about six miles from Agra. It stands in the centre of a large square garden, which has a lofty gateway of red sandstone in the centre of each of its sides. From these four gateways, which are upwards of 70 feet in height, four stone causeways converge to a central platform on which the mausoleum stands. The doorways on the tomb proper are marvels of beauty. The peculiar form of the arches, and the exquisite ornamentation made in

part by elaborate carvings and vari-colored stones, so placed as to form geometric figures, the colors so blended as to heighten the effect of each, and yet make a harmonious whole, at once rivet the attention of the observer with a fascination almost irresistible.

C. R. PANCOAST.

Waterbury, April 6, 1888.

GENERAL NOTES.

PHOTOGRAPHY AND ETHNOGRAPHY.—Ethnology is a science born of the present century and its application to art is of recent date. Formerly artists were content to journey to Italy, a few to Greece, but even these countries were visited more for the examination of the rich store of classical art or the paintings of the Renaissance in the public or private galleries than for direct study of the picturesque social life of the native inhabitants. The last fifty years revealed the beauties which lie, as it were, beyond the borders of our civilization, and artists began to discover the gorgeous coloring and marvelous contrasts of light and shade opened up in the Orient. We find distinguished painters, especially the French, engaged in depicting Oriental scenes. We have among the earlier products the Plague of Jaffa, and the Massacre of Scio; later on scenes in the harems and palaces and daily life of the children of the field and desert.

Photography is a valuable aid to the study of anthropology, not only in depicting with the greatest accuracy the manners and customs of the people with the surroundings of picturesque landscape, but also in determining the contour of the skulls of various people, the facial angles, etc. In order to discover affinity in nations Mr. Galton's ingenious method of composite photography might be of great value in showing the predominance of any peculiar characteristic in a series. Undoubtedly any constant factor would be emphasized above the variables. For instance, if it were desirable to know whether a certain race is broad skulled or narrow skulled, the superposition of a number of impressions would show the tendency to one or the other, also the shape and prominence of the nose and the facial angle, and the shape of the cavities of the eyes.

Or extending the study to civilized peoples, mixed races, it would be invaluable in determining the predominance of any one race element over another. We might determine whether, for instance, the Celtic or Saxon element in the British people had the ascendency, or confining ourselves to narrower limits it might be interesting in investigating what type of face, with its racial relations, characterizes poets, scientists, musicians, etc.; whether it be the broad skulled (the brachicocephalic) or the narrow skulled people (the dolicocephalic) which dominate. This would be more important than trying to deduce a typical face by which to characterize any one class of people: the special type should be disregarded altogether, and only the predominance of contour or the persistence of any one facial element taken into consideration.

It would be interesting, in more than a photographic sense, to know what racial element is controlling our own country. It has been claimed that in spite of the influx of every nationality into our social life the Anglo-Saxon still persists, and we remain children of the original stock.

Photography, either by means of a proper use of the composite method or by

generalization from observation of a great number of individuals, might tend to a settlement of the question.

Contour types of the Anglo-Saxon and the American face must first be determined for proper comparison. These types, we are assured, will be found to be vastly different from the conventional John Bull and Brother Jonathan.

PHOTOGRAPHY AND PATHOLOGY.—Dr. Eder, in *Photographische Correspondenz*, gives an interesting account of his visit to the Photographic Department of the Hôpital de la Salpetriere in Paris.

This famous institution is devoted to the treatment of females suffering from those peculiar nervous diseases, hysteria, hypnotism, epilepsy, etc., which excite the muscular system to spasmodic action.

The photographic section is under the management of Dr. Londe, and is amply supplied with all the appliances necessary for successful work, as well as special apparatus designed for taking a series of pictures in rapid succession.

The results obtained are not only very curious but exceedingly valuable from a medical point of view, in showing the persistency of the recurrence of special movements in the nervous derangement.

Dr. Eder's account of the photography of a hypnotic patient is very interesting. It is well known that a hypnotic person has no power whatever over his individual will, but is subject entirely to the will of the operator, obeying with promptness and blindly all his commands.

The patient operated upon was a handsome woman, with light hair, blue eyes and a fresh complexion, without the slightest external appearance of suffering from any nervous or other malady.

She was very easily put into a somnambulistic state, by the Doctor merely gazing at her intently for a short time.

She appeared to be asleep: the eyes were closed and the arms relaxed. The muscles by a stroke of the hand were made tense and rigid. Electricity of weak power worked more energetically. The electric current was so mild as not to have any influence whatever upon a person in normal condition, but was fully capable of producing the most striking effects upon the subject.

By a mere change of the point of application, expressions of anger, resignation, joy, grief, etc., could be called forth in the countenance. These excited emotions seemed to have a general effect upon the whole system, as there was a correspondence in the bodily motions with the peculiar expression of the features.

All these actions are quite involuntary, and depend solely upon the will of the operator. It will readily be seen of what value to science is the registry of these phenomena.

The hospital contains albums in which the various photographs are preserved for pathological study. Dr. Eder, in *Correspondenz*, gives several illustrations of these hypnotic patients.

He also gives the method of development employed by Dr. Londe for securing the best results. This may be of value to those of our readers who have no special interest in pathological studies. Pyro and ammonia, or pyro and soda are employed.

For the pyro and ammonia development, Dr. Londe dissolves dry pyro immediately before use in sufficient water to develop the plate, adding a few drops of solution of bromide of potassium (1-10), and a drop or two of dilute ammonia (1-10.)

To increase details in shadow the quantity of ammonia is increased. Increase of pyro gives increase of strength.

The pyro soda developer is made as follows:

10 c.m.^{3} of solution (crystallized), carb. of soda (1 : 5.)

10 c.m.^{3} of a solution of sulphate of soda (1-5), about 10 c.m.^{3} of water, and 5 c.m.^{3} of alcoholic solution of pyro (3-10.)

The resulting negatives are remarkably clear, and there is not the slightest trace of yellow color in the film.

COMMUNICATION.

PHILADELPHIA, APRIL 10, 1888.

To the Editor of THE AMERICAN JOURNAL OF PHOTOGRAPHY:

In making lantern slides from negatives which are too large to use by the method of contact printing, the slides must be made in the camera by daylight in order to secure the proper reduction in size. It recently occurred to the writer that the magnesium flash-light, produced by the use of Blitz-Pulver, might possibly serve to make slides in the camera at night. The principal difficulty appeared to be the fact that the plates available for use (Carbutt's A plates), might not be rapid enough to respond to the quick flash of the Blitz-Pulver, so every precaution was taken to secure the best possible illumination.

As no regular copying camera was available, an extemporized affair was made from a heavy pasteboard box, with a hole cut in the bottom of the shape and size of the negatives used, in this case 5x8 inches. This box was laid on its side on a table, and the negative fitted to the opening in the end and the camera placed by the table and focused on the negative, bringing the image to the proper size for a slide. A light board was then laid on top of the box and the camera, and a rubber focusing cloth thrown over the whole, thus forming a sort of tunnel through which the light might pass from the negative, and excluding all diffused light from the lens.

About three inches from the negative was placed a small screen consisting of a frame about twelve inches square, over which was stretched a piece of tracing linen. This was used in preference to ground glass as being more transparent and so adapted for diffusing the light with as little loss as possible. Six inches back of this screen was placed a small tin pan in which the Blitz-Pulver was flashed.

It will be seen from this that the light passed directly through the screen and negative to the lens, and so its action was much more direct than in the ordinary flash pictures where the light acts by reflection only.

About forty grains of Blitz-Pulver were used, and the resulting slides developed with ferrous oxalate developer, using a little citrate of ammonia as a clearer.

The slides appeared to be fully timed, the detail being perfect even in the densest parts of the negative, and when thrown on the screen were pronounced very satisfactory. The lens used was a Steinheil Antiplanetic, Series II. No. 4, with a stop of about *F* 6.

This method may permit many amateurs to make slides at night when their daylight hours, like the writer's, are too fully occupied with other matters to be made available for slide making.

H. H. SUPLEE.

INTERNATIONAL EXHIBITION OF AMATEURS' PHOTOGRAPHS AND PHOTOGRAPHIC APPARATUS.

On the occasion of the Jubilee of H. I. and R. Majesty the Emperor Francis Joseph I., at the I. and R. Austrian Museum of Arts and Manufactures in Vienna, from Sept. 15th till Oct. 25th, 1888.

To celebrate the Jubilee of his Majesty the Emperor Francis Joseph I., the Club of Amateur Photographers in Vienna intends holding an Exhibition of Photographs and Photographic Apparatus, a thing hitherto unknown in Austria.

The forthcoming Exhibition will, as may be seen by a glance at the appended schedule of classes, embrace every branch of Art and Manufacture connected with Photography, and thus will afford to those who make a study of the Art-science, whether professionally or otherwise, an opportunity of becoming acquainted with all the most recent improvements and developments introduced by home and foreign firms.

The Club's Daguerre Medal and Certificates of Honorable Mention will be awarded to the best Exhibit or Exhibits in each class of Photography, Photographic Apparatus, Lenses, etc., provided the jury deem any Exhibit or Exhibits of sufficient merit. From the decision of the jury there shall be no appeal.

As far as the Club's funds permit, the Club will purchase the most interesting Exhibits.

Amateurs have not to pay hire for the space allotted to them. On application they can obtain the use of frames free of charge.

A catalogue will be published, possibly with illustrations of the most interesting objects.

According to the Statutes of the I. and R. Austrian Museum for Arts and Manufactures, admission will be free five days a week.

CLASSIFICATION.

CLASS A.—PHOTOGRAPHS. *Section 1.*—1. Landscapes, architecture, interiors. 2. Portraits, groups, studies. 3. Genre-pictures, animals, still-life. 4. Instantaneous photographs. 5. Orthochromatic photographs. 6. Combination pictures. 7. Stereoscopic slides.

Section 2.—8. Astronomic photography. 9. Microscopic photography and Micro-photography. 10. Photogrammetric photographs. 11. Other scientific photographs.

Section 3.—12. Pictures of machinery and other industrial art-objects. 13. Magic lantern slides. 14. Photographs on wood, glass, linen, china. 15. Reproductions and enlargements.

Section 4.—16. Different negative processes. 17. Different positive processes. 18. "Lichtdruck," heliotype, photo-engraving, etc. 19. Sundries.

Section 5.—20. Photographs taken by artificial light.

CLASS B.—BIBLIOGRAPHY OF PHOTOGRAPHY.—21. Books about photography and the allied sciences.

CLASS C.—PHOTOGRAPHIC APPARATUS AND APPLIANCES.—22. Cameras for studios, reproduction, detectives, etc. 23. Tripods and studio stands. 24. Studio and laboratory furniture and appliances. 25. Lenses. 26. Instantaneous shutters. 27. Sciopticons, enlarging apparatus, magic lanterns. 28. Apparatus for artificial light. 29. Stereoscopes, graphoscopes, etc. 30. Complete outfits for amateurs. 31. Dry plates, positive and negative paper, etc. 32. Mounts, albums, etc., etc. 33. Frames. 34. Sundries.

N. B.—Applications in Classes B and C will not be accepted unless accompanied by the proper remittance.

RULES AND REGULATIONS.

1. Applications on the blank form, properly filled up, are to be sent in to the Executive Committee not later than July 1st, 1888.

2. All goods and pictures, accompanied by a customs-declaration and carriage-paid, must reach the Executive Committee not later than August 20th, 1888. Exhibits from abroad are free from duty if re-exported.

3. The Executive Committee reserves to itself the right of rejecting any Exhibits.

4. Amateurs have not to pay rent or any other charges.

For Classes B and C the following prices have been fixed:

(*a*) For insertion in the catalogue, not exceeding half a page, 16s. 6d.; for each succeeding half-page, 13s. 6d. The catalogue will have an appendix of advertisements, for which the rates will be: For a whole page, 25s.; half a page, 13s. 6d.; a quarter of a page, 8s. 6d.; an eighth of a page, 5s. 6d.

(*b*) For placing, use of show-case, and suitable decoration of the first square metre of space occupied (floor, table, wall), 16s. 6d.; for each succeeding square metre, 8s. 6d.

(*c*) Five per cent. of price received for any articles sold at the Exhibition.

(*d*) No Exhibits will be allowed to be removed before the close of the Exhibition. The Executive Committee will have all objects insured against fire; but, while exercising all reasonable care, will not undertake any responsibility for other damage or loss.

5. At the close of the Exhibition each exhibitor, or his deputy, must pack and remove his goods at his own expense. Messrs. Schenker & Co. will, if desired, undertake this for foreign exhibitors.

6. The Executive will assign spaces and determine the arrangement of Exhibits.

7. Frames will be lent to amateurs free of charge.

8. A non-transferable admission ticket will be supplied to each exhibitor, which will pass the holder into the Museum without payment on each day of the Exhibition.

9. No dangerous or explosive substances shall be admitted.

10. The Executive Committee reserves the right of issuing further rules.

11. All communications and remittances to be addressed to the Chairman of the Executive Committee, Herrn Carl Srna, VII. Bezirk, Stiftgasse 1, Vienna.

THE first number of a new photographic magazine makes its appearance this month. It is called *Science of Photography*, and is published by James W. Queen &

Co., Phila. Mr. Joseph J. Fox is the Managing Editor, Dr. W. M. Sweet, Associate Editor, and Mr. Xanthus Smith, well known for his excellent writings about the relation of Art to Photography, has charge of the Art Department. The Editor in his announcement to the public remarks that "while there are a number of good photographic papers published in this country and abroad, we think there is room for one more first-class journal conducted upon the plan which the publishers of the *Science of Photography* have adopted."

We, accordingly, feel gratified that part of the plan of the publishers of *Science of Photography* should be the selection for the initial number of two of the recent papers published in our AMERICAN JOURNAL OF PHOTOGRAPHY, as thereby we are evidently ranked by the Editor amongst those "good and first-class papers" to which reference is made in the announcement.

We would, however, feel more elated had the Editor seen fit to credit our JOURNAL with the excerpta.

We shall always be pleased to have the *Science of Photography* appropriate whatever is desired from the pages of the AMERICAN JOURNAL OF PHOTOGRAPHY, but would ask that in the future credit be given when credit is due.

DR. H. E. ARMSTRONG, in a paper read before the Chemical Society, touched upon the connection between the color and constitution of matter. He remarked that the majority of compounds, especially those of carbon, and in the case of elements whose compounds are invariably colored, the greatest diversity of coloring, is often noticeable among the several compounds of one and the same element, as in that of chromium or manganese, for example; it is therefore clear that color is in a high degree conditioned by special forms of intra-molecular structure, and, consequently, that any attempt to determine the origin of color must be based on a knowledge of the structure of colored matters. For this reason it has become possible only within recent years to discuss the relation between color and constitution.

W. H. WALMSLEY & Co. have favored us with their illustrated catalogue of Photographic Cameras, Lenses, and other apparatus and materials for photographing. It is quite an encyclopedia of useful information about all photographic requisites. We took much interest in reading the description of the many new things which have been recently introduced to the profession, and also the many contrivances by which the amateur can pursue the delightful art with ease and comfort.

Messrs. W. H. Walmsley & Co. are well known throughout the country as agents for the Celebrated Beck Lenses. The catalogue also contains numerous formulæ, photographic recipes, and directions for manipulation, which will be found of practical value to amateurs. W. H. Walmsley & Co., 1016 Chestnut St., Phila.

TONING BLUE PRINTS.—Dr. J. McCraith, in a communication to the British *Journal of Photography*, describes a method for converting the ordinary blue print into one of a brownish-purple tone. He takes ordinary blue paper and prints rather deep, washes well, and then puts it in a bath of twenty grains tannic acid and three drops hydrochloric acid; here it is allowed to remain a few minutes, then rinsed off

and treated to a bath consisting of liquor potassa 10 drops, water 2 oz., until it turns a rusty red color; after another rinse it is bathed in hydrochloric acid and water, 1 dr. to 1 oz. water, until the tone required is obtained; it is then again rinsed and dried.

WE have received Vol. I., No. 8, of the *Export Journal*, an international circular for the Book, Paper, Printing and allied trades. It is printed in French, German and English, and the contents furnish excellent reading. The paper on Photographic Printing Processes, by Edmund Gaillard, will be read with interest by photographers. The information crowded into this paper will be found of great value. The *Journal* is published monthly, and is under the management of G. Hedeler, Grimmaischer, Steinweg 3, Leipzig, Germany.

THE *Boston Academy* is the title of a publication devoted to educational interests, published in Boston under the management of Rev. Alfred A. Wright, D. D. The contributions and papers will be found of great value to students, especially the twelve lessons in New Testament Greek which began with the January number. The lucid explanation given will enable anyone to understand the beautiful language in which the gospel is written. The *Academy* is published to subscribers at fifty cents a year, 38 Bromfield St., Boston.

THE beautiful photographs of the tombs and temples of India were not printed from the original negatives of Mr. Pancoast, but from reproduced negatives. It was feared that the large number of prints demanded by our extensive circulation might injure the valuable originals.

We are indebted to Mr. W. H. Rau, who has possession of the originals, for the excellent reproductions, which bear evidence to his skill as a photographer.

Camera Boxes:

1—8 x 10 American Optical Co.'s Royal Camera, double swing and carriage movement, . 30 00
1—4x5 Bijou Camera, and two holders, ... 8 00
1—4x5 Novalet Camera holder, new 10 50
1—5x7 Flammang revolving back camera, three holders, extension tripod, Darlot wide angle lens and canvas case . . . 55 00
1—4x5 Photo-Microscopic enlarging outfit, ... 14 00
1—11x14 Blair reversible back, extension front view, box and 3 holders, ... 40 00
1—5x8 Tourist Outfit, including 5x8 Tourist Camera Box, 2 Daisy Plate Holders, 1 Extension Tripod, and 1 Canvas Carrying Case, very little used. Price, new, $40.50, will sell for 30 00
1—4x5 '76 outfit 15 00
1—10x12 Cone View Camera, Double Swing, new 52 80
1—11x14 New Haven Reversible Back Camera, Double Swing, new 44 00
1—14x17 New Haven Acme Portrait Camera, Single Swing, new 46 00
1—4x4 Standard Portrait Camera wet holder, new 14 75
1—4x5 Flammang revolving back Camera, new, ... 25 00
1—4¼x5½ No. 202 A. Scovill Outfit 20 50
1—6½x8½ View Camera and Lens 12 00
1—5x8 Wet Plate Stereo Camera, 3 holders, case and tripod . 25 00
1—6½x8½ American Optical Co., first qual. View Camera . . 23 00
1—4¼x5½ Ex. qual. Portrait Camera 17 50
1—5x8 American Optical Co., Stereo Camera 25 00
1—6½x8½ Standard Portrait Camera, with holder 13 60
1—5x8 Blair View Camera, single swing 17 00

Lenses:

1—8x10 Morrison Peerless Portrait Lens, ... 40 00
1—14x17 Harrison wide angle view 18 00
1—Matched pair German Stereoscopic Lenses, in good order . 15 00
1—5x8 Dallmeyer View Lens . . 15 00
1—Woodward Condensing Lens 10 00
1—4x4 Darlot Globe Lens . . . 25 00
1—4x4 " " " . . . 20 00
1—5x8 Abendroth wide angle view lens 15 00
1—⅓ size L. W. Krantz Portrait Lens 12 50
1—½ size C. C. Harrison portrait lens. 8 00
1—¼ size portrait lens 3 00
1—½ size Darlot quick acting Portrait Lens, central stops . 18 00
1—No. 6, 17x20 Darlot wide-angle Hemispherical Lens 40 00
1—Extra 4x4 Chapman Portrait Lens 20 00
1—8x10 E. A. View Lens . . . 5 00
1—Ross View Lens 5 00
1—H. Fitz Double View Lens, revolving stops 8 00
1—8 x 10 Voigtlander Portrait Lens 80 50
1—4x4 Dallmeyer Group Lens . 50 00
1—4x4 Walzl Portrait Lens . . 20 00

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